Application of Real-Time Rainfall Information System to CSO control

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Presentation Points

■ Objectives

- To verify the applicability of the real-time rainfall information network
- To control CSOs through efficient operation of existing facilities

■ Conclusions

- Evaluation of forecast information (rainfall, water level) is needed
- Comprehensive approach, including project items other than CSO controls is needed

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2. Outline of the area covered by this study
3. Application of the real-time rainfall information network for CSO control
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1. CSO control items in Japan and the item covered in this study

■ CSO control items in Japan (current targets)

① To reduce pollution loads to level of separate sewer systems

② 50% reduction in frequency of discharges of untreated wastewater

③ To remove debris from pipes

※Separately, it has been made against

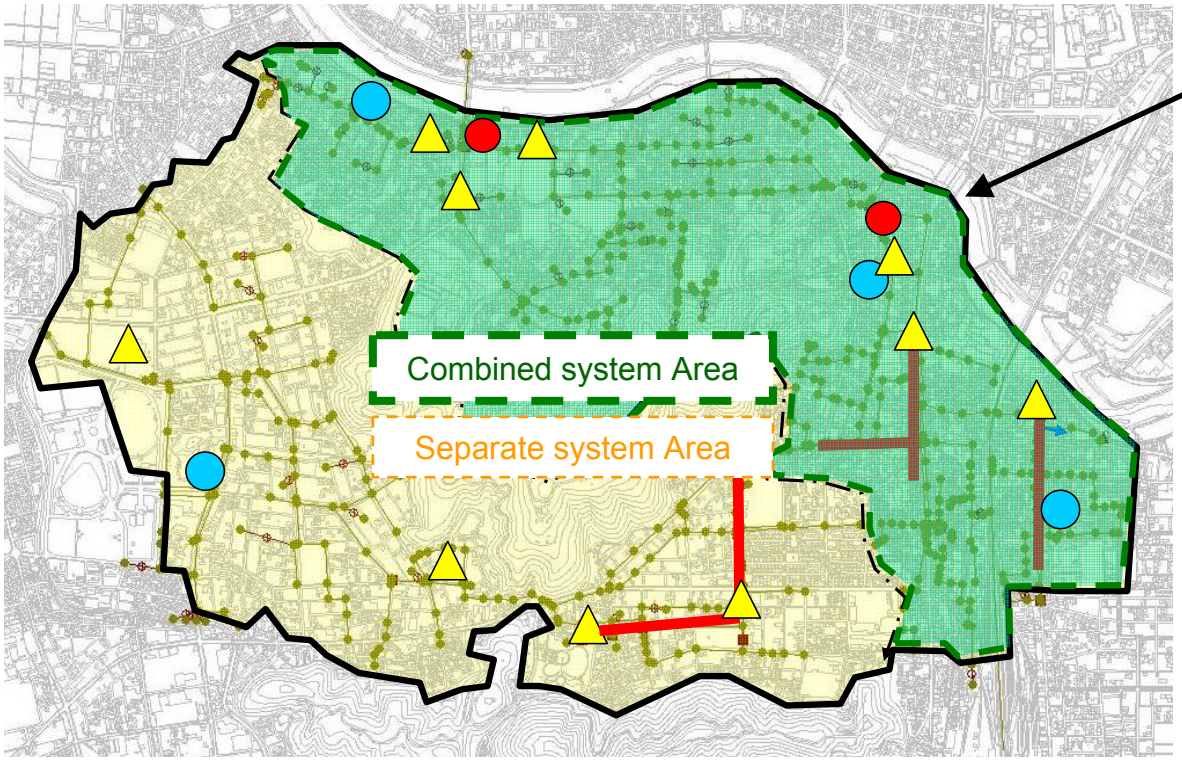
Item dealt with this time

The item dealt with here is 50%-reduction of the frequency of discharges of untreated wastewater

2. Outline of the area covered by this study

Outline of the research field

- Currently real-time rainfall information network has been constructed for this research field (530ha) to reduce flood damage
- This field has rain gauges and level gauges
- There are also pumping stations and stormwater storage pipes
- This network is used to connect these devices to form a network
- The cost of introducing network in 2010 was approximately 200 million yen

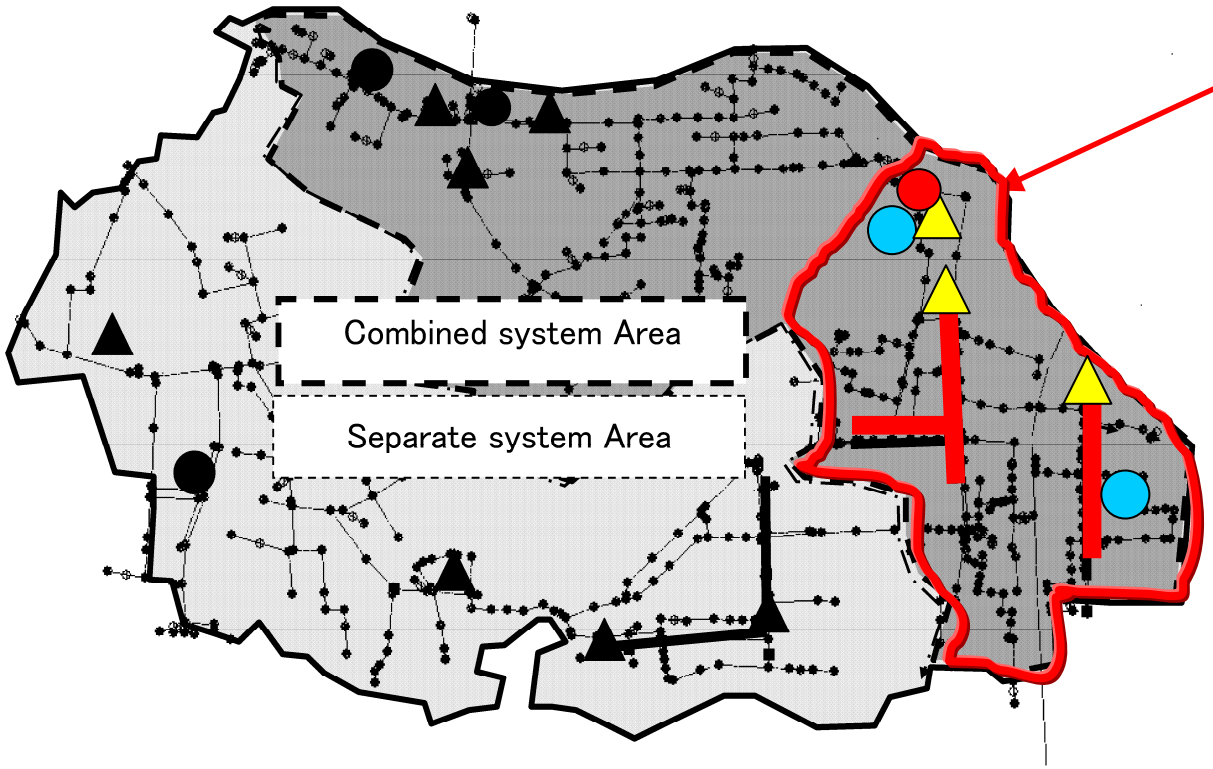


Area of research field:
530ha

Devices in 530ha		
	Classification	No. of installation points
●	Rain gauge	4 points
▲	Level gauge	10 points
●	Pumping station	2 points
━	Stormwater Storage pipe	3 points

Outline of the area covered by this study

- Area covered by this study is in the research field (120ha)
- It has a combined system and it is a one-pump drainage area
- This report focuses on the existing two stormwater storage pipes used to cope with flooding
- Such pipes can hold approximately 3,600m3
- This volume is equivalent to 3.0mm/hr

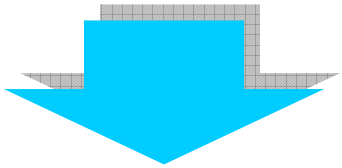


Area covered by this study:120ha

Devices in 120ha		
	Classification	No. of installation points
●	Rain gauge	2 points
▲	Level gauge	3 points
●	Pumping station	1 points
━	Stormwater Storage pipe	2 points

Target of CSO controls by this study

Target was a 50-percent reduction of the frequency of discharges
(Pumping station　104 times/year　⇒　52 times/year)



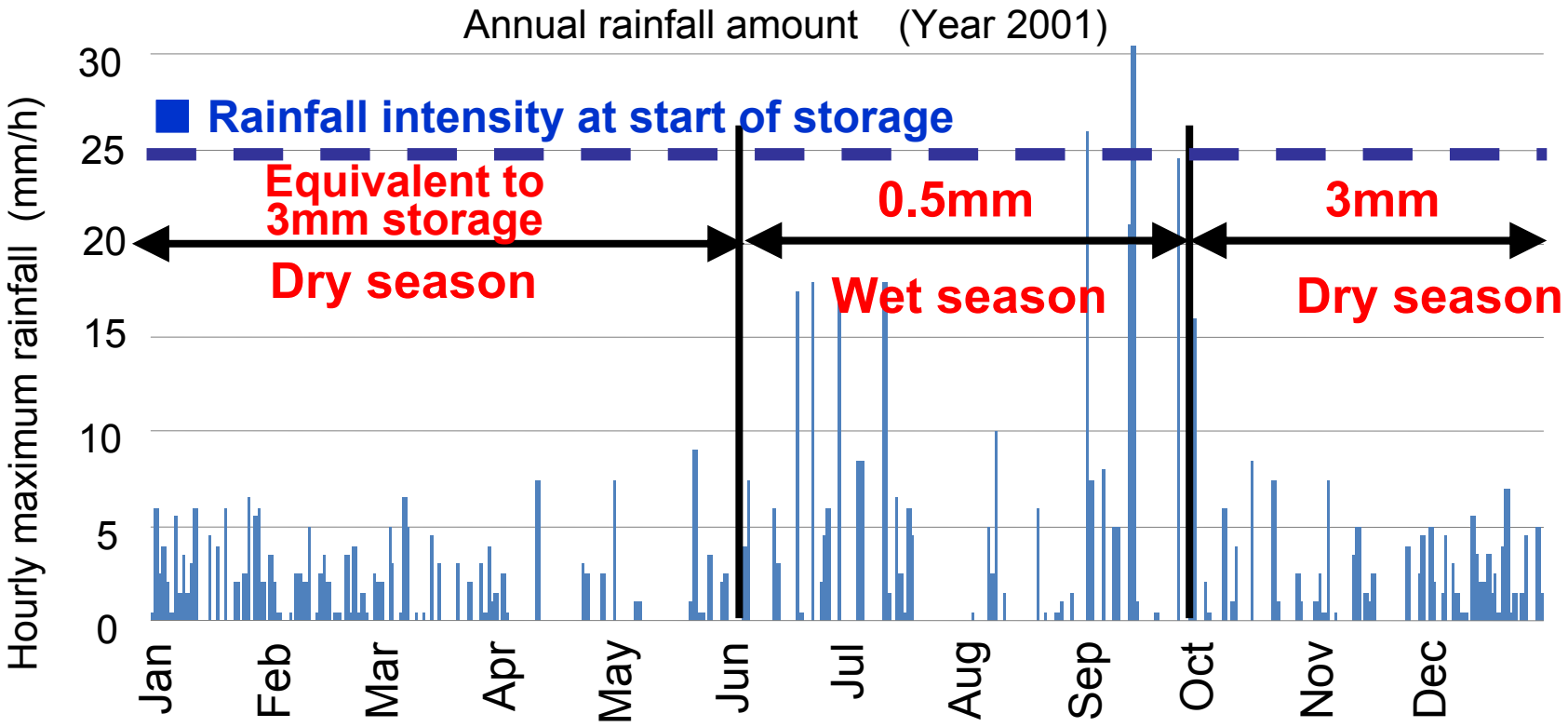
A new storage facility with a capacity equivalent to 2mm was needed

* Source: Existing CSO control plan

3. Application of the real-time rainfall information network for CSO control

Conceptual view of CSO control through efficient operation of the existing storage pipes

New storage capacity (2 mm equivalent) for CSO controls
=Storage volume to be added to the existing storage pipe through efficient operation
=3 mm equivalent in dry season and 0.5 mm equivalent in wet season

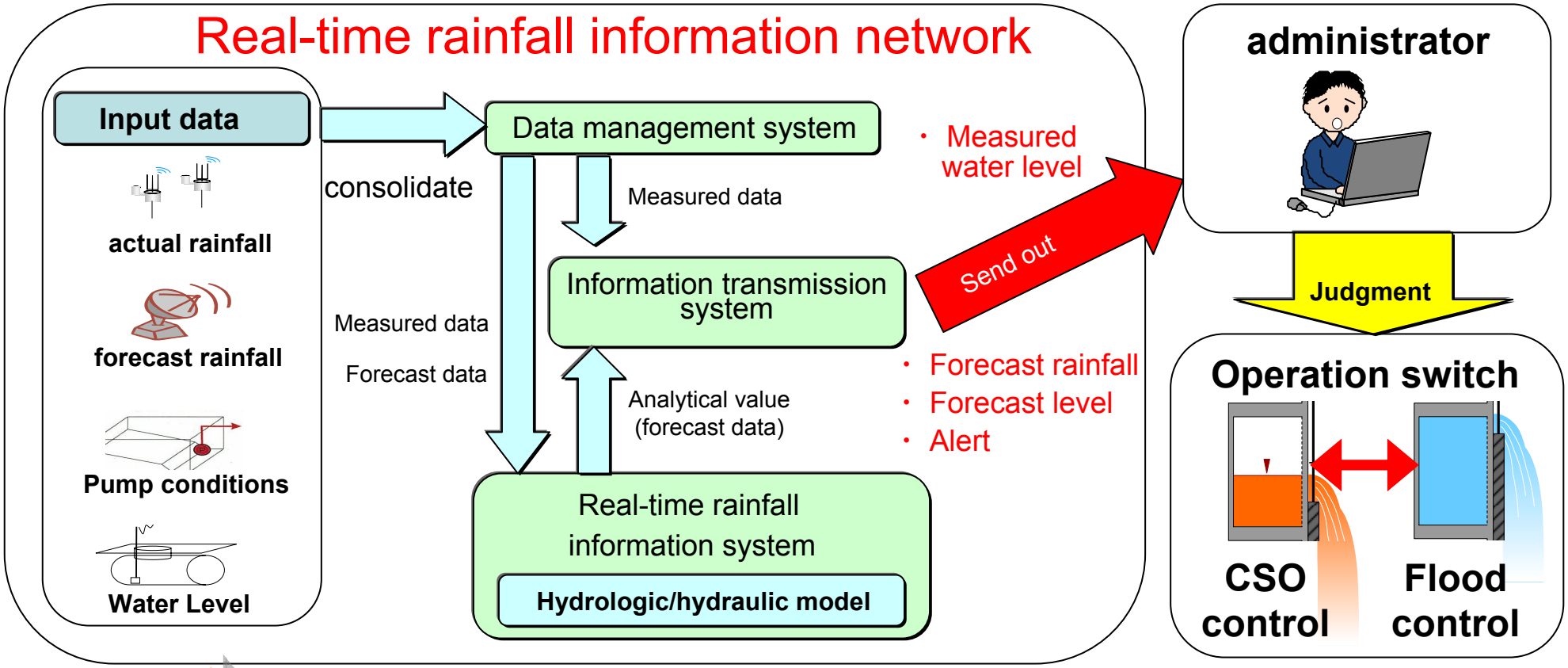


However

This operation pattern becomes possible only when **forecast data** is available to enable determination of the switching of operations

Outline of the real-time rainfall information network

The network is used to obtain the necessary forecast data
→Administrator determines the switching storage pipes

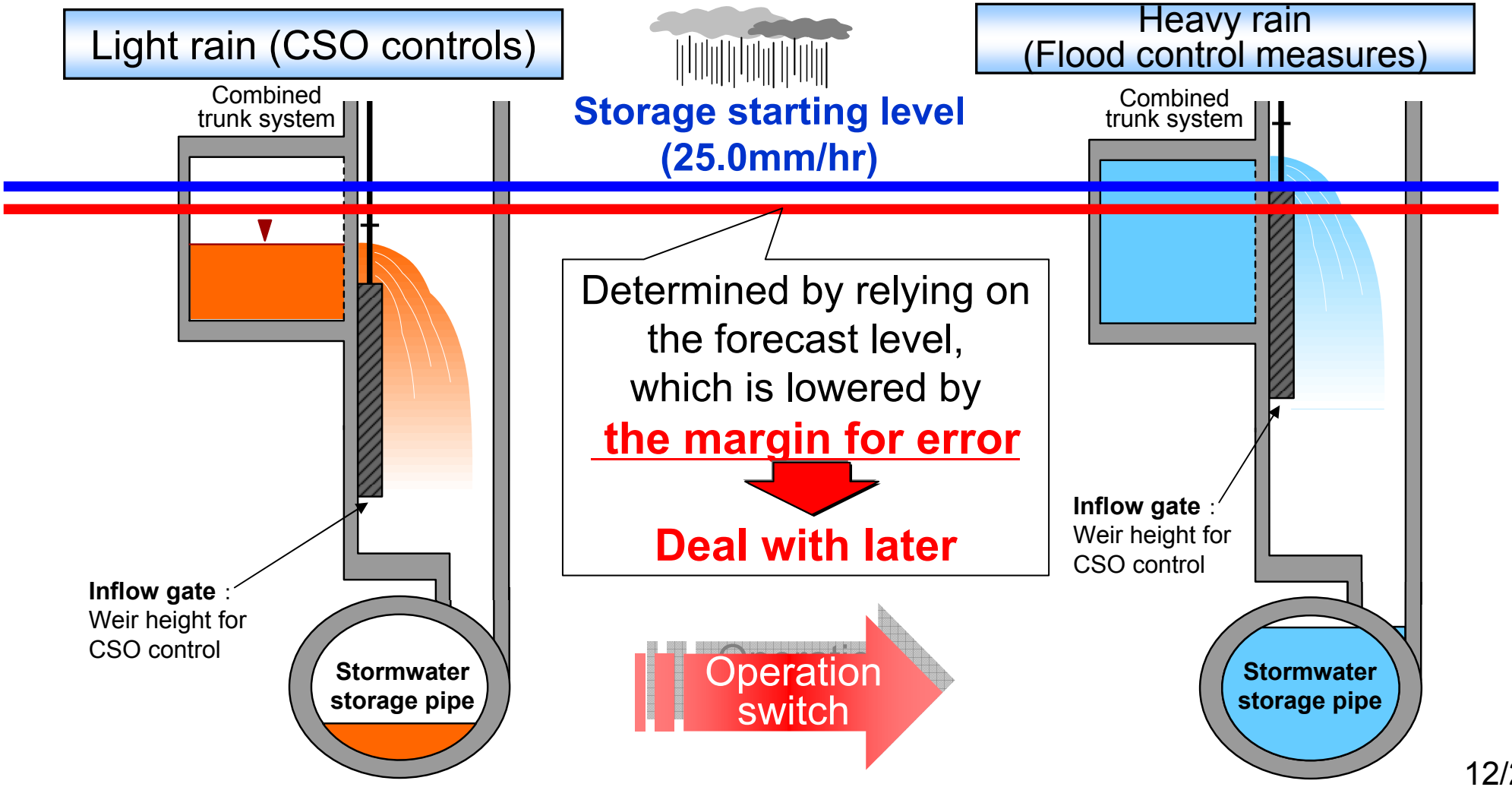


In this way

The network supports efficient operation of CSO control

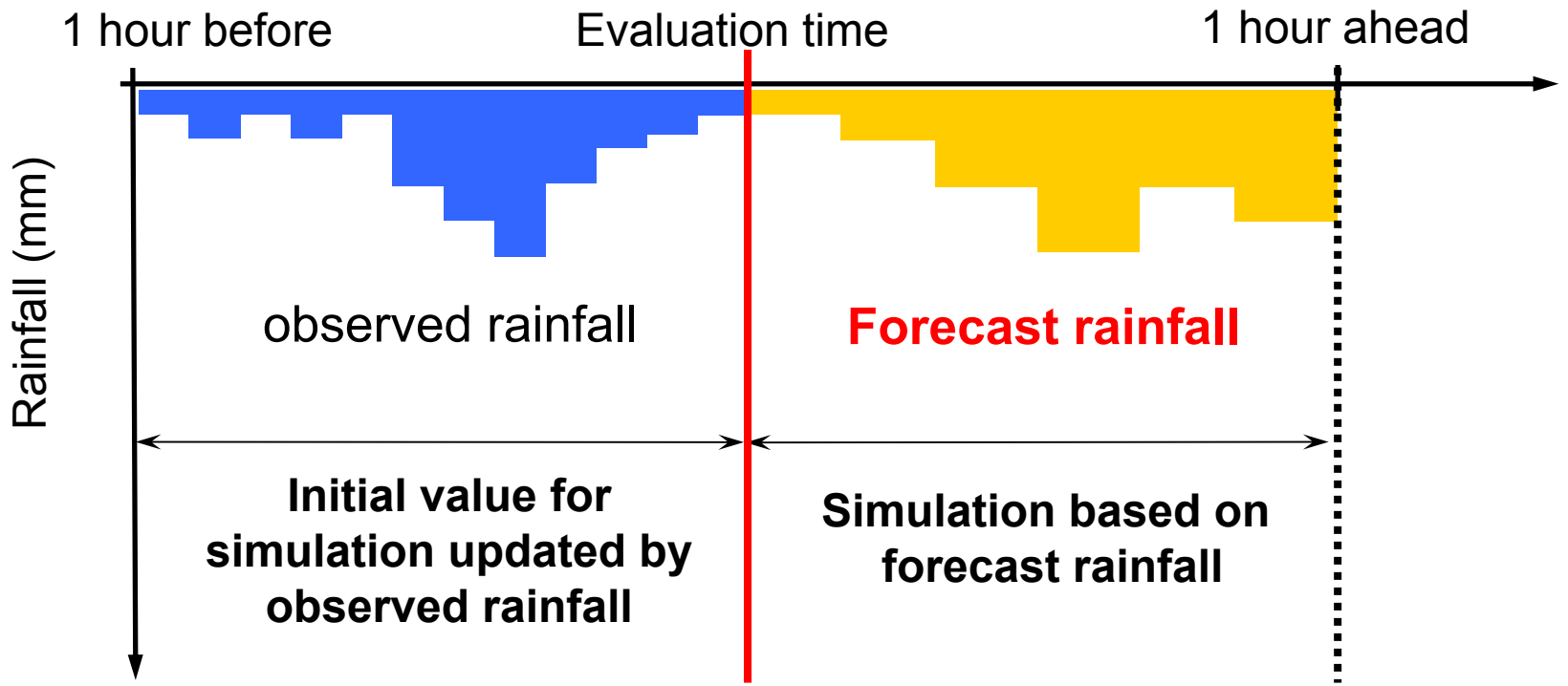
Conceptual view of efficient operation

We decide whether or not to switch operation on the basis of the forecast level at the storage pipe intake point.



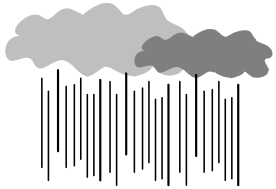
Outline of forecast rainfall data

- We use the forecast rainfall data distributed by the Meteorological Agency, which is one hour ahead
- Simulation based on Hydrologic/hydraulic model uses the observed past data and the forecast rainfall

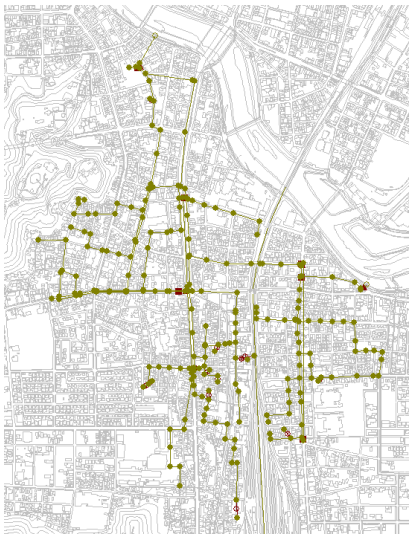


Rainfall and water level

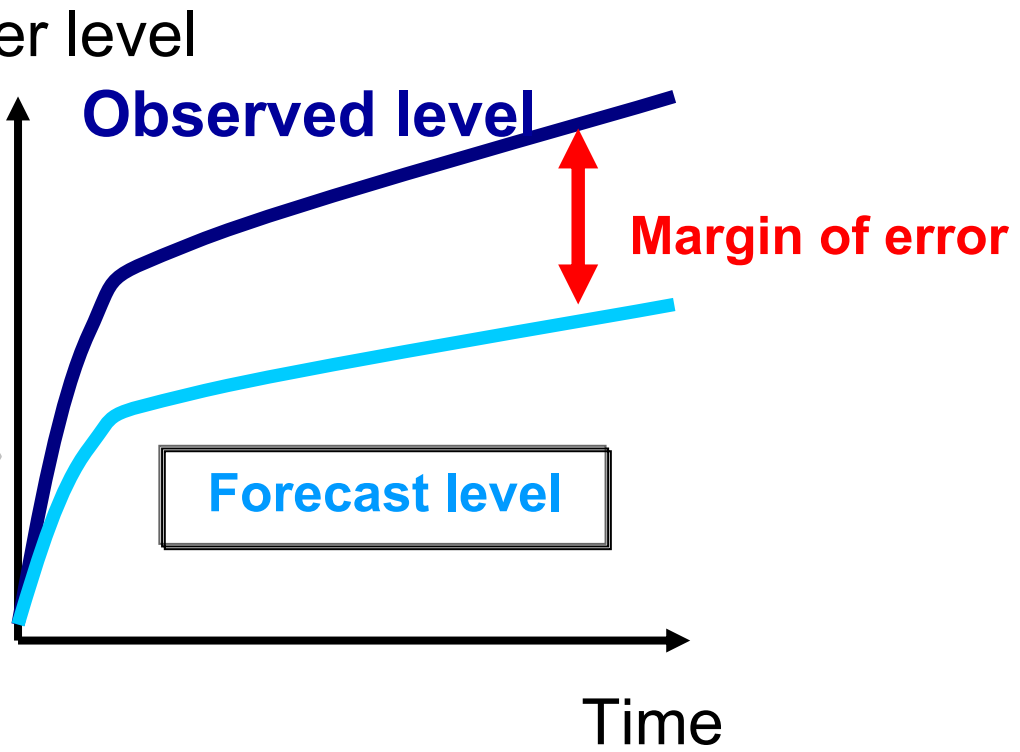
Forecast level is calculated by using the Hydrologic/hydraulic model and observed/forecast rainfall



Observed/Forecast rainfall

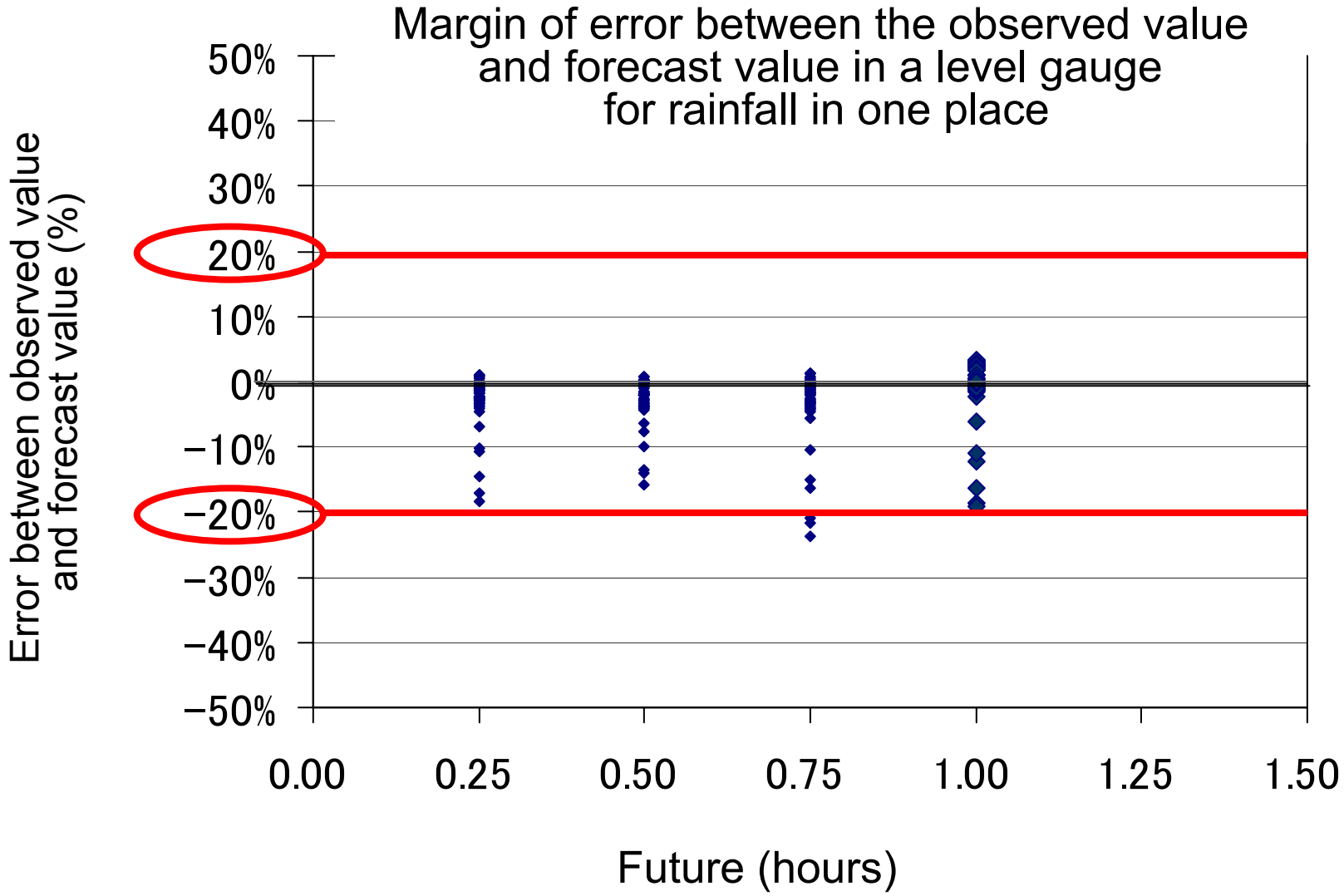


Hydrologic/hydraulic model



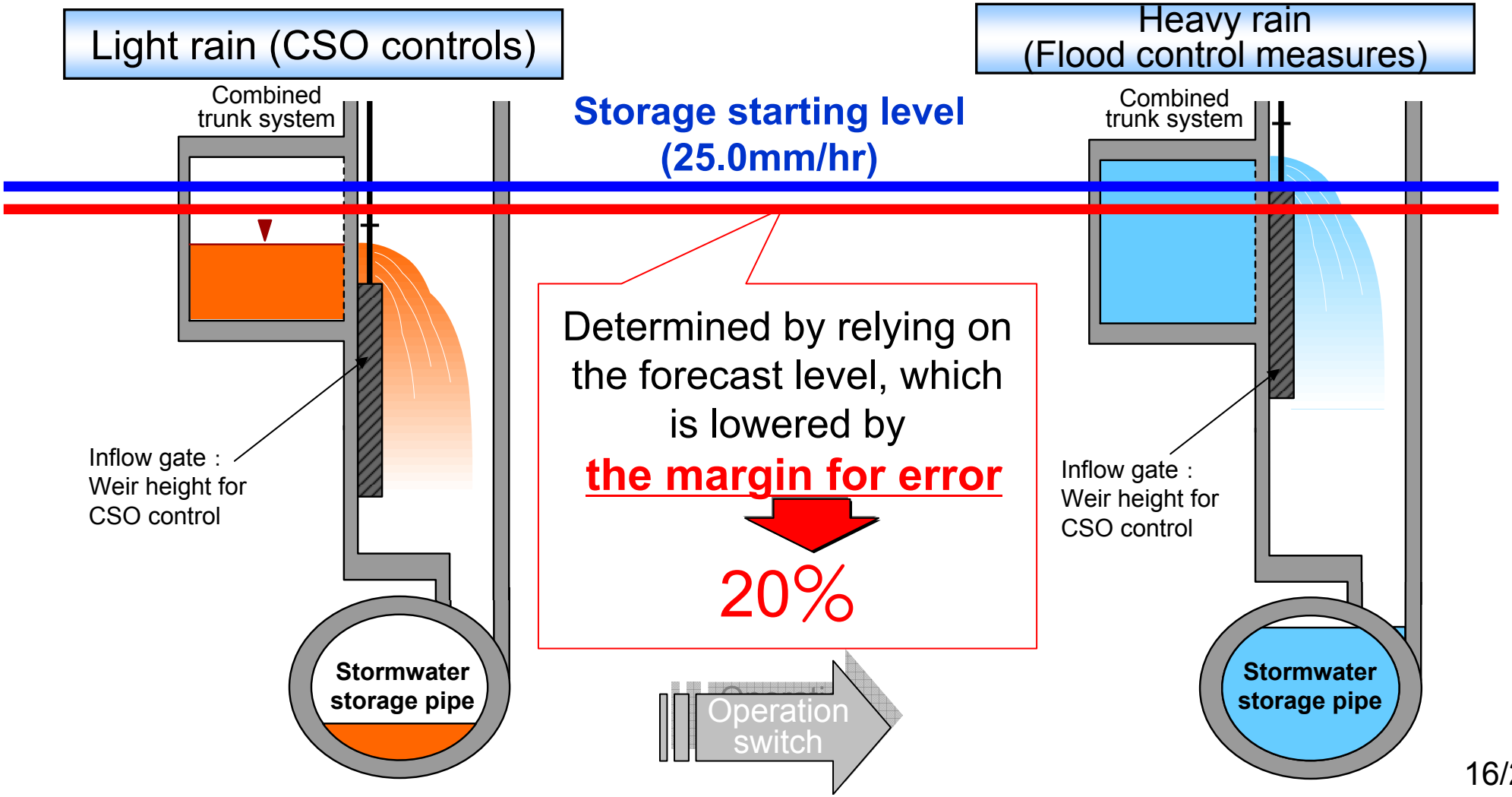
Accuracy of forecast water level (1/2)

The margin of error for forecast levels one-hour ahead is about 20%



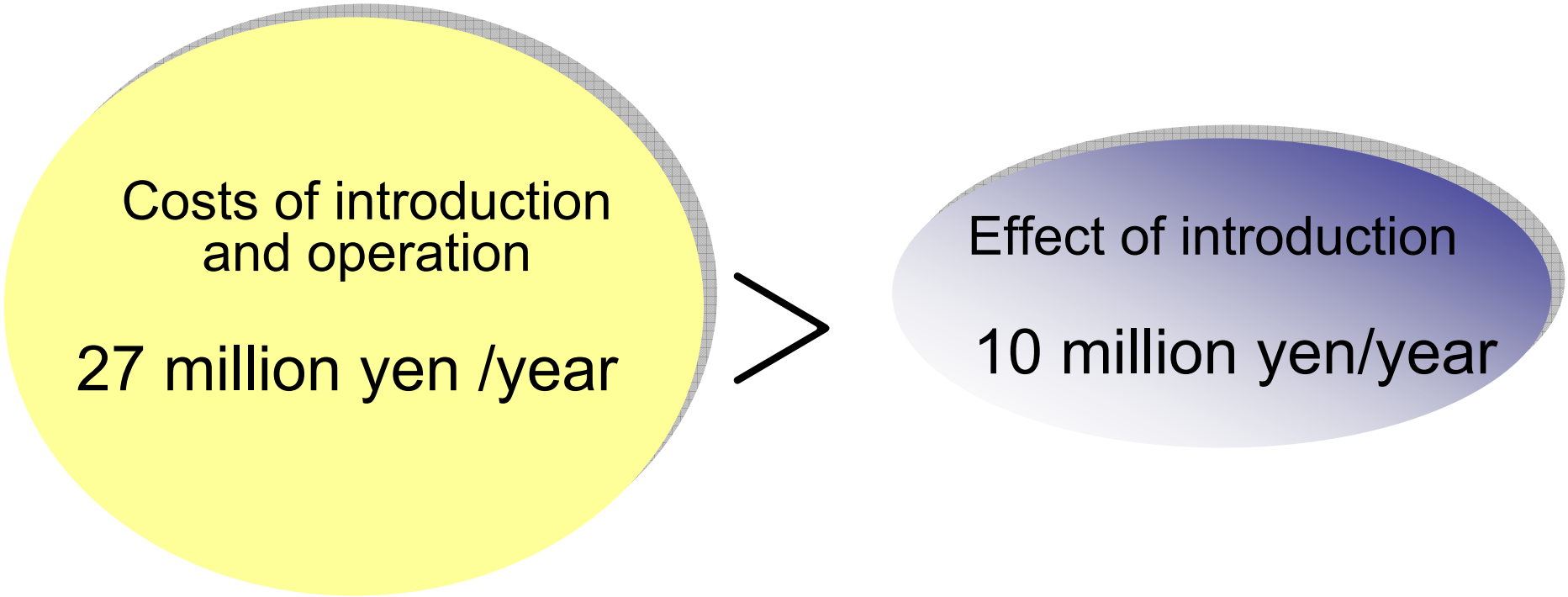
Accuracy of forecast water level (2/2)

This system is operated, taking the above accuracy (20%) into account



Cost-effectiveness

- Introducing the system has a small effect on CSO control
- The duration of this evaluation is ten years.
- The following values are equivalent per year.



Overall cost effect over the whole research field

- CSO control only can lead to limited effect on costs
- When other effects are included, the ratio of improvement effect to cost of introduction is as high as 2.8
- Because of advantages gained from economies of scale, introducing this system in the wider area will produce much greater effects

Item		Annual cost (thousand yen/year)	
Costs for introduction and operation (**C**)		**27,000** (Equipment replacement in ten years)	
Improvement effect (**B**)	Flood control measures	64,400	74,700
	CSO controls	**10,000**	
	Energy reduction	300	
B/C = 2.8			

*Results obtained for the entire research field of 530 hectares

4. Summary and tasks ahead

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■ Summary

The following measures are needed to apply the real-time rainfall information network:

- Evaluation of the forecast information(rainfall, water level)
- Comprehensive approach including project items other than CSO controls

■ Tasks ahead

① To demonstrate and verify the effects of introduction
→ This is currently being done in the research field

② To raise forecast analysis accuracy
→ Incorporating data from MP rainfall radar is expected to enhance the accuracy of the system

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